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Experimental History of Science: Galileo's experiments with pendulums

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Galileo Galilei (1564-1642) has fascinated students of the natural sciences, mathematics, philosophy, and religion for centuries. Galileo has also sparked fierce controversies, about the value of natural science, for instance, and especially about its laying a normative claim to a privileged form of knowledge of the natural world.

Galileo despised the philosophers of certain schools of his time, who, in his view, considered it their job, a priori and at all cost, to defend the doctrines of Aristotle (384-322 BCE). Some of those philosophers despised him. Yet when hired by the Grand Duke of Tuscany, in 1610, Galileo claimed for himself the title of "philosopher". On what ground?

It was an innovative methodology in natural philosophy, namely, sustained investigation of the natural world through experiment and mathematics, that led Galileo to claim the title of philosopher. In this paper, I study Galileo's innovative methodology. I call it experimental philosophy. I investigate how, when Galileo is at work, epistemic norms regulate, and are regulated by, the practice of experiment. My approach is essentially based on re-enactment (on which more below).

Aside from a few comments scattered throughout his writings, Galileo never wrote a systematic treatise on his methodology. So a legitimate question is whether in his investigative strategies Galileo was consciously employing epistemic norms, and whether and to what extent the epistemic norms evolved under the challenges of his evolving praxis. During years of research, and finally after repeating for myself some of Galileo's experimental work with pendulums, I became convinced that Galileo's experimental philosophy is not the clever seizing of opportunities, or the result of opportunistic adaptation to social circumstances. His investigative strategies are imprinted by epistemic norms, which, in turn, are under constant negotiation with praxis. His experimental philosophy eventually brought him to challenge the then received view that knowledge of causes is the very fabric of natural science. My project aims to illuminate Galileo's achievement by re-enacting Galileo's experiments with pendulums.

I approach Galileo's experimental philosophy as an integrated historical, philosophical, and material object. Firstly, I regard the object as historical in that its formation is rooted in the intellectual traditions of the late Renaissance. Secondly, I regard the object as philosophical in that it has a great deal of underlying normative structure which can be isolated, further clarified, and, still today, re-enacted as a coherent set of theoretical commitments. Thirdly, I regard the object as material in that it is inseparable from material artefacts that cannot be understood solely from a perspective internal to texts.

The investigation of Galileo's experimental philosophy, therefore, requires a methodology which combines historical and philosophical sensitivities with material skills. The methodology that I practice consists in: exploring historical questions by re-enacting a historical actor's epistemic commitments, and recovering a genuine form of experience by re-enactment of experiments.

In sum, I hope that the experimental approach to the history of science, exemplified in this paper, will contribute to the debate on experimentation in the natural sciences that has intrigued historians and philosophers of science over the last several decades. In the wake of other scholars who have adopted experimental approaches to the history of science, I also wish to argue that there is much to learn from re-enacting the

experimental practices of scientists. Until not long ago the history and philosophy of science was dominated by hermeneutic work on the written records left by scientists (typically of a past period). While obviously fundamental, and indeed indispensable to re-enactment itself, textual hermeneutics need not be exclusive, especially when experimentation is invoked in scientific texts. It can and should be complemented with re-enacted experimental practices. For, as I have learned, the meaning of texts invoking experiments may remain inaccessible from a perspective internal to the texts. But it can be restored on the basis of re-enacted practices.



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